# CHP Applications in the Midwest



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#### DOE

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# What is CHP?

- Integrated System
- Located At or Near A Building/Facility
- Provides a Portion of the Electrical Load
- Utilizes the Thermal Energy
  - Cooling
  - Heating
  - Dehumidification
  - Process Heat



# 1

# How CHP Saves Energy





15-22% Losses after Generation and Usable Heat Recovery 50-40% Usable Recovered Heat





# **CHP Technologies**

- Cooling Equipment
  - Mechanical Chillers
  - Absorption Chillers
  - Thermal Storage
  - Desiccant Dehumidification
- Heat Recovery Systems
  - Hot Water
  - Steam
- Electric Generation Equipment
  - Reciprocating Engines
  - Turbines/Microturbines
  - Fuel Cells





#### **Electric Generation Devices Comparison**

Technology Comparison	Diesel Engine	Gas Engine	Simple Cycle Gas Turbine	Microturbine	Fuel Cell
Product Rollout	Commercial	Commercial	Commercial	1999 – 2000	1996 – 2010
Size Range (kW)	20 – 10,000+	50-5,000+	1,000+	30 – 200	50 – 1000+
Efficiency (HHV)	36 – 43%	28-42%	21-40%	25 – 30%	35-54%
Genset Package Cost (\$/kW)	125 – 300	250-600	300 – 600	350-750*	1500 – 3000
Turnkey Cost – no heat recovery (\$/kW)	350 – 500	600-1000	650 – 900	600 –1100	1900 – 3500
Heat Recovery Added Costs (\$/kW)	n.a.	\$75-150	\$100 – 200	\$75 – 350	incl.
O&M Cost (\$/kWh)	0.005-0.010	0.007-0.015	0.003 – 0.008	0.005 – 0.010	0.005 – 0.010

<sup>\*</sup>Commercial target price





## Why Is There An Opportunity?

- DOE/EIA Project Over 360 GW of New Capacity
  - To Meet Growing Demand
  - To Compensate for Plant Retirements
- Today's Central Station Plants Lose 23 Quads of Thermal Energy
- Aging Electric Transmission/Distribution System
  - Difficult to Site New Lines
  - Capacity Constrained
  - Costly to Maintain





### Why is There an Opportunity?

- Rising Concerns Over
  - Blackouts/Brownouts
  - Power Supply Constraints
  - Electricity Prices

Selected Power Outage Costs

Industry	<b>Avg. Cost of Downtime</b>		
Cellular Communications	\$41,000 per hour		
Telephone Ticket Sales	\$72,000 per hour		
Airline Reservations	\$90,000 per hour		
Credit Card Operations	\$2,580,000 per hour		
Brokerage Operations	\$6,480,000 per hour		



# Why Consider CHP?

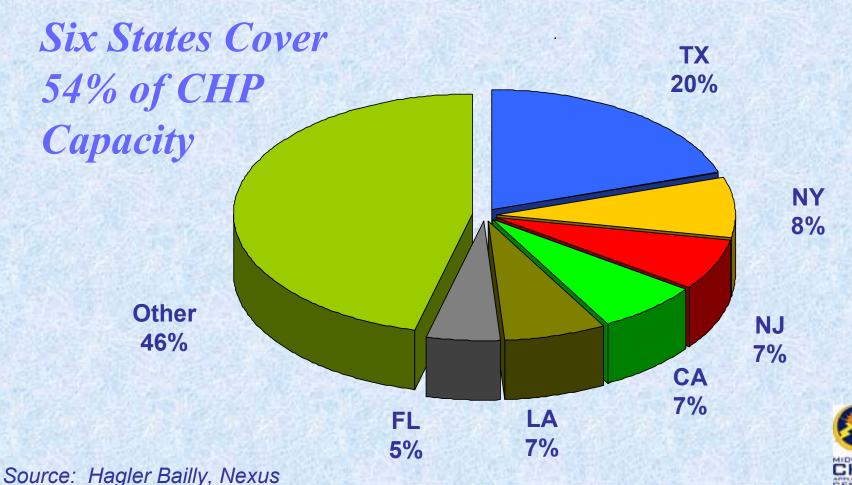
- Peak Electric Power Reduction
- High Efficiency Up to 80%
- Power Security and Quality
- Significant Emissions Reductions
  - 40% Less than Central Plants
  - Improved Indoor Air Quality
- Supports the Electric Grid Infrastructure
  - Grid Reliability
  - Defers Costly Grid Updates
  - Provides Price Stability





# **Existing Industrial CHP**

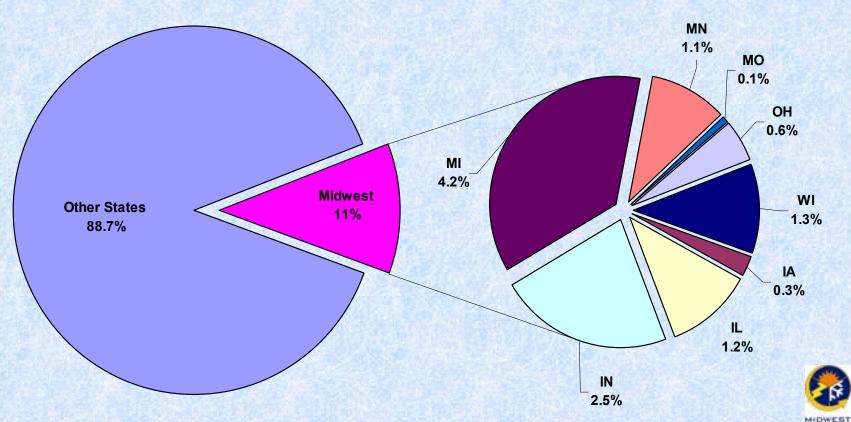
45.5 GW





### **Existing Industrial CHP (Midwest)**

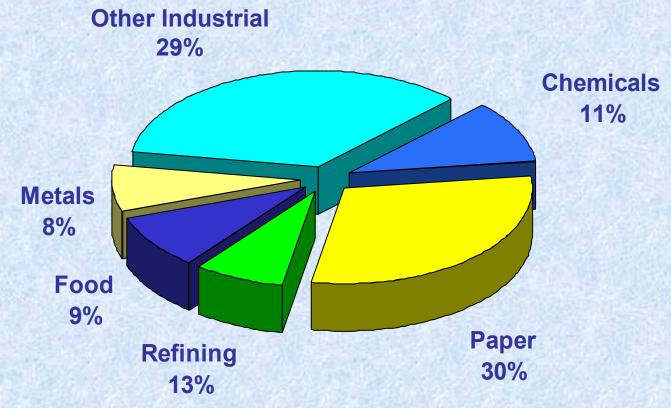
5.2 GW (11.3% of Total U.S. Installed – 45.5 GW)





#### Potential for Industrial CHP is Large

Estimated CHP Potential: 88 GW



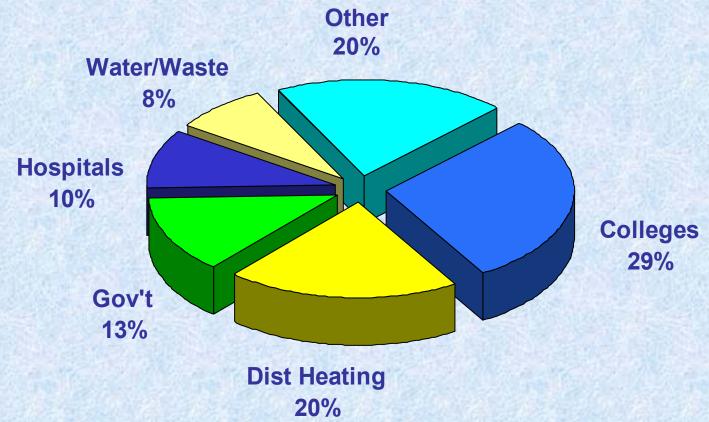
Source: Nexus





# **Existing Commercial CHP**

Existing Commercial CHP Capacity 4.93 GW



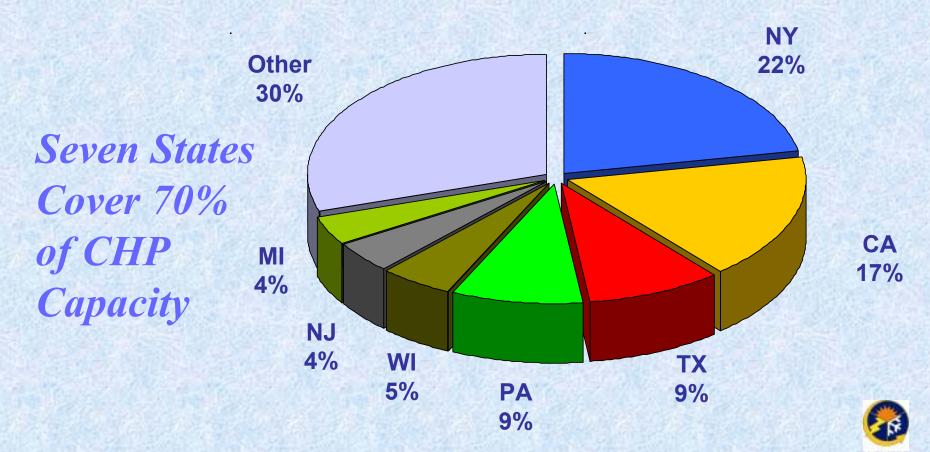
Source: Hagler Bailly, Nexus





# **Existing Commercial CHP**

Existing Commercial CHP Capacity: 4.93 GW

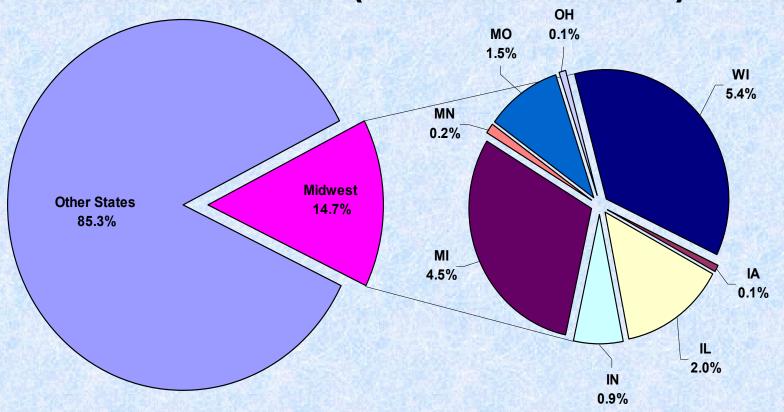


Source: Hagler Bailly, Nexus



### **Existing Commercial CHP (Midwest)**

.7 GW (14.7% of Total U.S. Installed – 4.93 GW)

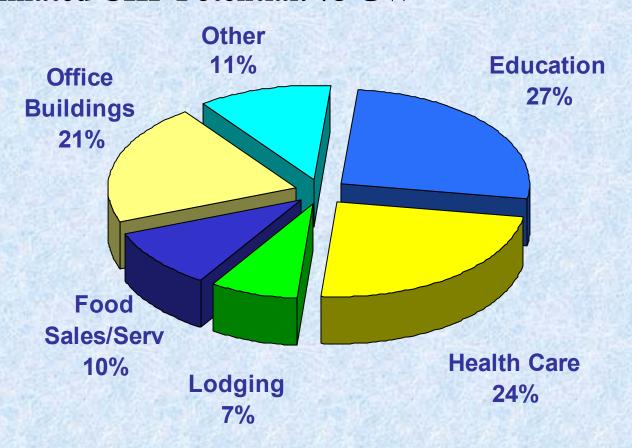






# Potential for CHP in Commercial Applications Is Large

#### **Estimated CHP Potential: 75 GW**









# Critical Policy Issues

- Tariff Design
  - Standby / Back-up Power Rates
- Renegotiated Rates
- Interconnection Requirements
- Stranded Cost Recovery and Exit Fees
- Environmental Permitting





#### Critical Market Challenges

- Education and Awareness
  - Technical Feasibility
  - Financial Viability
  - Other Benefits
- Identifying Full Economic Value
- Financing
- Market Uncertainty





#### Significant Barrier - Misconceptions

- Poor/Middle Class will Pay More as Customers Unplug
  - Shoulder Larger Share of T&D Costs Stranded Assets
- Loss of Grid Sales
- Distributed Energy will Displace New Low Emission Central Station Generation
  - Increase Emissions in Urban Areas





### What is Not Communicated

- Important Role in Moderating Prices
  - Reduce Peak Loads in Critical Areas
    - Reduces Grid Infrastructure Costs
  - Increasing Supply to Reduce Growth
    - CHP at Best Could Displace 10% to 15% of the Projected Growth
  - Meets Energy Needs at a Lower Cost
    - Provides Part of Electricity Needs
    - Fully Utilize Waste Heat





#### What is Not Communicated

- Decrease Grid Costs
  - Improve Grid Utilization
  - Peak Shaving
- Diversify Supply
- Positive Impact on Emissions
  - Lower NOx, CO2, SO2
    - Over Most States Current Generation Mix
  - Excludes Diesel Fueled Generators





#### Outreach Programs in the Midwest

# Midwest CHP <u>Application Center</u>

- DOE Funded Project
- UIC/ERC & GTI



#### Midwest CHP Initiative

- Coalition (Voluntary)
- Founding Members
  - GTI
  - UIC/ERC
  - Delta Institute
  - ELPC
  - NiSource

Promote the Use of CHP in the Midwest





#### Midwest CHP Initiative

- Voluntary Coalition of Interested Organizations
  - GTI
  - UIC/ERC
  - Delta Institute
  - ELPC
  - US DOE Chicago Regional Office
  - NiSource
  - Peoples Energy
  - Northeast/MidwestInstitute

- Illinois DCCA
- Indiana Department of Commerce
- Wisconsin Division of Energy
- Michigan PublicService Commission
- Minnesota Department of Commerce
- US EPA
- US EPA Region V





Mission: Double the Amount of CHP in the

Midwest by 2010

Focus: Work to Remove Marketplace and

Government Barriers to CHP Development

#### Committees:

- Permitting
- Education
- Policy
- Market Development
- Bimonthly Meetings
- Develop/Implement Action Plans





#### Midwest CHP Initiative

- CHP Permitting Guidebook
- CHP Grid Interconnect Workshop
- CHP Policy Platform -- State Commissions
- Comments on Several State/Federal Issues
- Participate in Midwest/Federal Conferences
- Market Development Action Plan





#### **Mission**:

Develop Technology Application Knowledge and the Educational Infrastructure Necessary to:

- Reduce Perceived Risks
- Foster CHP for Buildings as a Viable:
  - Technical and Financial Option
  - Energy and Environmental Option

#### Focus: (Foster Project Identification)

- Education
- Information
- Project Assistance





#### Partnership:

- University of Illinois at Chicago
   Energy Resources Center --- UIC/ERC
   and
- Gas Technology Institute --- GTI

#### Sponsorship:

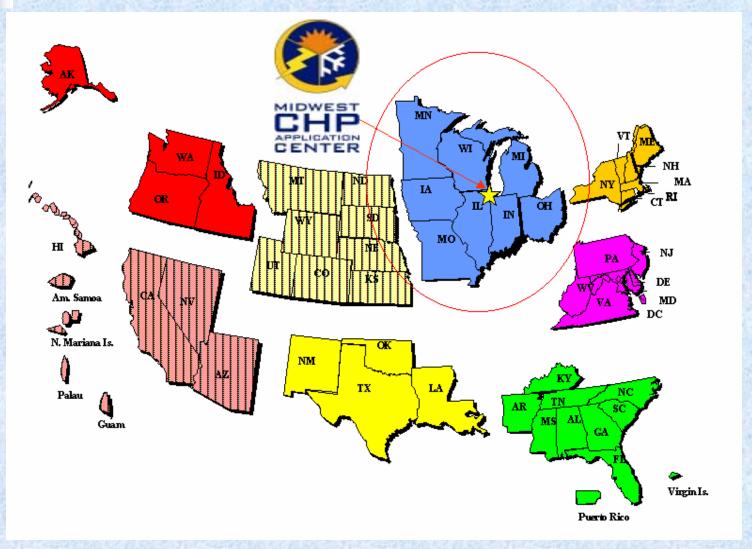
DOE Office of Power Technologies

#### Technical/Program Guidance:

Oak Ridge National Laboratory --- ORNL



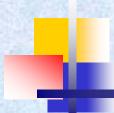






- Baseline Assessments (Illinois/Michigan)
- Planned and Implemented Grid Interconnection Workshop
- US EPA Partnership Program (July 9<sup>th</sup> Illinois Workshop)
- Regional Application Center Guidebook (Draft)
- Technical Assistance Program Implemented
- Case Studies
- Website www.CHPCenterMW.org
- CHP Training





# Project Support (Services)

- Initial Screening Assessments
- Technology Education
- Viable Site Assessment Visits
- Case Studies
- Assist in Project Justification
- Partnership Assistance
- Feasibility Assessments
- SWAT Team Assistance





#### FEMP's CHP Tech-Specific Program

 Partnering with DOE's Office of Power Technologies, the CHP Industry and others to make advanced CHP easily accessible to federal agencies through FEMP's ongoing assistance programs







#### FEMP's CHP Tech-Specific Program

Support Project
Facilitators on
Super ESPC
Building Retrofits

Design Assistance (DA) on New

Construction

Assistance on Building Retrofits Financed by Utilities, Other ESPC, or Appropriations

CHP Procurement
Challenge
Recommendations

CHP New Tech Demonstration Program Documents

CHP Core Team
At ORNL







#### For Further Information

#### **Midwest CHP Application Center**

www.CHPCenterMW.org

Leslie Farrar (UIC/ERC): (312) 413-5448

#### **Midwest CHP Initiative**

www.nemw.org/uschpa/regional.htm

Ted Bronson (GTI): (847) 768-0637

#### **FEMP**

www.eren.doe.gov/femp/

Patrick Hughes (ORNL): (865) 574-9337

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